

FRESHWATER CLADOCERA (CRUSTACEA : BRANCHIOPODA) OF THE ANDAMAN AND NICOBAR ISLANDS¹

K. VENKATARAMAN²

(With one text-figure)

Key words: Cladocera, 38 species, Andaman and Nicobar Islands

During 1990-92, 221 Cladocera samples were collected from 106 freshwater habitats throughout the Andaman and Nicobar Islands. A total of 38 species belonging to 21 genera of five families were identified, of which 24 were chydorids and 14 nonchydorids. The seven regions, viz. north, middle, south and little Andaman, Carnicobar, Nancowry group and Great Nicobar, were divided into two groups for the present study. All the seven stations were compared by the Sorensen index of similarity, and Koch index of biotal dispersity. The indices are generally high, reflecting the small number of species involved and their wide distribution, but two groups of stations are easily discernible. The indices for the Nicobar group of islands are somewhat lower, being influenced by the erratic occurrence of eurytopic species such as *Moina micrura*, *Ceriodaphnia cornuta* and *Macrothrix spinosa*, but they are clearly interrelated.

INTRODUCTION

The Andaman and Nicobars consist of over 550 islands, including several archipelagoes with a land area of 8,293 sq km. Being oceanic islands, they have hilly terrain and virgin forests, free flowing streams and cavities where water logging takes place throughout the monsoon. Irrigation reservoirs or lakes are absent, except for a few very small dams used mainly for drinking water (Danikari dam and Diltaman tank, Port Blair). A few perennial water bodies, and many temporary cavities and rice fields are the main wetlands, where this study was conducted.

The Cladocera are dominant micro-crustaceans in the freshwater habitats of the Andaman and Nicobar islands, but they are not known taxonomically and ecologically as compared to those in the surrounding regions, such as the Indian mainland (Venkataraman, 1983; 1992a; Michael and Sharma, 1988; Venkataraman and Das, 1993), Sri Lanka

(Rajapaksha and Fernando, 1987), Malaysia (Idris, 1983) and the Philippines (Mamaril, 1977). Except for Venkataraman (1991, 1992b, c), no worker has studied the freshwater bodies of Andaman and Nicobar Islands. Hence, this study on the occurrence of Cladocera was undertaken in the freshwater habitats of Andaman and Nicobar Islands.

MATERIAL AND METHODS

During 1990-92, 221 samples of Cladocera were collected from 106 freshwater habitats throughout the North (NA), Middle (MA) and South Andaman (SA), (Diglipur, Mayabunder, Rangat, Kadamthala, Port Blair, Havelock, Ross Islands and Little Andaman), Carnicobar (CN), Nancowry Group (NG) and Great Nicobar (GN) of Nicobar Islands (Fig. 1). Samples were collected from ponds, marshes, reservoirs, rice fields, dams, streams and rainwater pools, using a plankton net of 45 cm diameter, with circular mouth. The samples were usually collected in shallow water, among vegetation and in clear water. The net was dragged close to the bottom; excessive stirring of the mud was avoided. This technique gave a qualitative sample of shallow

¹Accepted November, 1997

²Zoological Survey of India

100, Santhome High Road,
Chennai 600 028, Tamil Nadu, India.

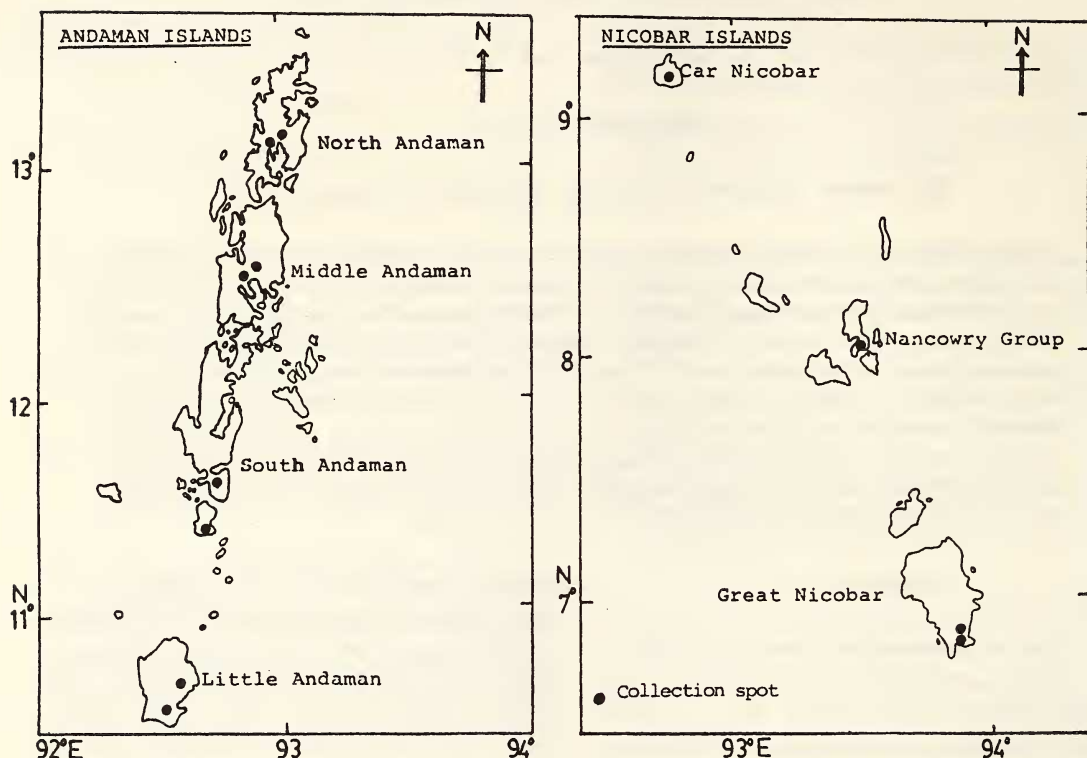


Fig. 1: Map of Andaman and Nicobar Islands showing the collection spots

water invertebrates living on the substratum, among vegetation and in the water column as in rice fields or marshes. The normal annual rainfall was 3,180 mm, mean max. temp. 29.98 °C and the mean min. temp. 23.13 °C. The mean relative humidity was 79%.

DESCRIPTIONS OF SOME RARE SPECIES

Brief descriptions of five rare species reported in the present study are given below. All the other 33 species recorded in this study have been described by Michael and Sharma (1988) from the Indian mainland, Malaysia (Idris, 1983) and Sri Lanka (Rajapaksha and Fernando, 1987).

Family Sididae

Diaphanosoma volzi Stingelin 1905

Material examined: 5 females from

Bomila creek marsh, Little Andaman.

Female: Body size 0.73 mm. Head rounded and small, eye relatively large. Valves straight on ventral margin, duplicature forming a wide angle, posteroventral corner rounded, without denticles except for a long spine on the posterior margin. Postabdomen with three long and sharply pointed basal spines.

Remarks: Very rare. The material agrees with the description often mentioned under the name *D. aspinosum* by Chiang (1956) from China, and by Idris (1983) from Malaysia.

Family Macrothricidae

Guernella raphalis Richard 1892

Material examined: 3 females from Hut Bay nalla, Little Andaman, several females from roadside ponds in Wandoor, Port Blair.

Female: Body size 0.41 mm. Carapace

slightly oval. Head rounded anteriorly and concave ventrally; eye large, ocellus at the apex of rostrum. Antennule short and broad with lateral setae. Valves with polygonal reticulations, broadly rounded distally, ventral margin rounded and serrated. Claw short without basal spine.

Macrothrix laticornis (Jurine 1820)

Material examined: 6 females from Kadamthala fish pond (NA).

Female: Body size 0.48 mm. Head rounded; rostrum small with two antennules implanted with a bunch of subapical long spines and four rows of dorsal spines. Ventral margin with movable spines. Postabdomen thick and swollen, with numerous fine spines.

Family Chydoridae

Pleuroxus denticulatus Birge 1879

Material examined: 5 females from Yatrik pond, 7 females from Schoolline pond, 22 females from Coast Guard pond.

Female: Body size 0.42 mm. Shape broadly oval, with striated carapace. Posteroventral corner with 2-4 denticles. Rostrum long and pointed. Ocellus situated closer to the eye than to apex of rostrum. Postabdomen with 14-16 denticles with two basal spines on the claw.

Alona cf. dentifera (Sars 1901)

Material examined: 9 females from Murugan temple pond, 6 females from Schoolline pond, Port Blair (SA).

Female: Body size 0.45 mm. Valves with longitudinal lines. Posteroventral corner rounded, with three denticles. Ocellus slightly smaller than eye, situated half-way between eye and tip of rostrum. Labrum rounded anteriorly, slightly pointed ventrally. Postabdomen with prominent preanal and postanal corner, with 11 groups of denticles. Claw long, with a long basal spine.

Remarks: Rare. New record to India. Idris (1983) shifted this species from the genus

Alonella to *Alona*. More studies are required to confirm the identity of this species.

RESULTS AND DISCUSSION

A total of 38 species belonging to 21 genera of 5 families were identified in the 221 samples collected from different habitats during 1989-1991, of which 24 were chydorids and 14 nonchydorids. Of all the samples, only 10 contained no cladocerans. There were great differences between the islands in the number of cladocerans collected (Table 1).

As in the Northeast (Venkataraman, 1994, 1995), as well as Tamil Nadu and Rajasthan (Venkataraman, 1983, 1992a), cladocerans of the Andaman and Nicobar Islands are a mixture of tropical and temperate species (Table 2). *Ceriodaphnia cornuta*, *Moina micrura* and *Diaphanosoma excisum* are considered to be typically tropical species widely distributed from the northernmost tip Diglipur, to the other end, Great Nicobar. *Diaphanosoma volzi*, *Macrothrix laticornis*, *Pleuroxus denticulatus*, *Chydorus pubescens*, *Alona cf. dentifera* and *Leydigia acanthocercoides*, which are considered to be temperate in origin, occur in Andaman and Nicobar Is. (Table 1).

Cladoceran hatching and growth rate is controlled by temperature, which ranged from 29-32 °C (Table 3) in the study. The pH range of these wetlands was narrow, 7.25 to 8.90. Previous workers Bayly (1963), Moitra and Bhattacharya (1965) and Chengalath (1982) showed that Cladocera and other freshwater zooplankton populations vary inversely with pH. However, the present study does not show any such significant variation.

The study areas receive monsoon rain from March through October. This continuous rainfall dilutes the ionic strength and nutrient levels of the water, which in turn may affect the proliferation of cladoceran population. It also increases the oxygen content of the water along

FRESHWATER CLADOCERA OF THE ANDAMAN AND NICOBAR ISLANDS

TABLE I
OCCURRENCE OF CLADOCERA (IN NUMBER OF SAMPLES) IN DIFFERENT REGIONS OF ANDAMAN AND NICOBAR ISLANDS (TOTAL NUMBER OF SAMPLES COLLECTED IS GIVEN IN PARENTHESIS)

Sl. No.	Cladocera species	Andaman				Nicobar		
		North Andaman (20)	Middle Andaman (30)	South Andaman (96)	Little Andaman (44)	Carnicobar (10)	Nancowry Group (6)	Great Nicobar (15)
Family Sididae								
1.	<i>Pseudosida bidentata</i>	2	-	-	-	-	-	-
2.	<i>Latonopsis australis</i>	-	-	3	1	-	-	1
3.	<i>Diaphanosoma sarsi</i>	3	4	10	3	-	-	2
4.	<i>Diaphanosoma excisum</i>	1	3	28	-	-	-	-
5.	<i>Diaphanosoma volzi</i>	-	-	-	1	-	-	-
Family Daphniidae								
6.	<i>Ceriodaphnia cornuta</i>	5	7	18	6	3	1	3
7.	<i>Scapholeberis kingi</i>	-	1	7	-	-	-	-
Family Moinidae								
8.	<i>Moina micrura</i>	6	13	19	5	-	-	1
9.	<i>Moinodaphnia macleayi</i>	-	-	5	-	-	-	-
Family Macrothricidae								
10.	<i>Macrothrix spinosa</i>	1	1	9	3	-	1	3
11.	<i>Macrothrix laticornis</i>	-	1	-	-	-	-	-
12.	<i>Echinisca triserialis</i>	-	-	18	2	-	1	-
13.	<i>Ilyocryptus spinifer</i>	-	1	7	3	-	-	-
14.	<i>Guernella raphalis</i>	-	-	2	1	-	-	-
Family Chydoridae								
Subfamily Chydorinae								
15.	<i>Pleuroxus similis</i>	-	-	-	4	-	-	-
16.	<i>Pleuroxus denticulatus</i>	-	-	6	-	-	-	-
17.	<i>Chydorus ventricosus</i>	-	1	19	3	-	-	-
18.	<i>Chydorus reticulatus</i>	7	13	22	5	-	-	-
19.	<i>Chydorus eurynotus</i>	5	6	9	2	-	1	1
20.	<i>Chydorus parvus</i>	-	1	6	-	-	-	-
21.	<i>Chydorus barroisi</i>	-	-	17	-	-	-	-
22.	<i>Chydorus pubescens</i>	-	1	-	-	-	-	-
23.	<i>Dadaya macrops</i>	1	2	8	2	-	-	1
24.	<i>Dunhevedia crassa</i>	-	2	12	3	-	-	1
25.	<i>Dunhevedia serrata</i>	-	1	7	-	-	-	-
Subfamily Aloninae								
26.	<i>Alona monacantha</i>	1	-	8	-	-	-	-
27.	<i>Alona cf. dentifera</i>	-	-	3	-	-	-	-
28.	<i>Alona pulchella</i>	-	6	12	4	-	-	-
29.	<i>Alona guttata</i>	-	2	-	-	-	-	-
30.	<i>Alona davidi</i>	-	-	18	5	-	-	-
31.	<i>Alona karua</i>	2	5	12	3	-	-	-
32.	<i>Alona verrucosa</i>	-	-	6	-	-	-	-
33.	<i>Oxyurella sinhalensis</i>	-	-	10	-	-	-	-
34.	<i>Kurzia longirostris</i>	1	-	7	2	-	-	1
35.	<i>Euryalona orientalis</i>	-	-	4	-	-	-	-
36.	<i>Notalona globulosa</i>	2	-	7	-	-	-	-
37.	<i>Leydigia acanthocercoides</i>	1	1	3	-	-	-	1
38.	<i>Leydigia australis</i>	-	-	4	-	-	-	-
Total number of species		14	20	32	19	1	4	10

FRESHWATER CLADOCERA OF THE ANDAMAN AND NICOBAR ISLANDS

TABLE 2
OCCURRENCE OF SPECIES OF CLADOCERA IN DIFFERENT STATES OF INDIA

Sl. No.	Name of the family	Number of species of Cladocera					
		Tamil Nadu	Rajasthan	West Bengal	Tripura	Andaman and Nicobar	India (total)
1.	Sididae	5	5	5	5	5	6
2.	Daphniidae	12	12	9	7	2	17
3.	Moinidae	2	4	3	2	2	5
4.	Bosminidae	-	1	2	2	-	2
5.	Macrothricidae	4	8	6	4	5	8
6.	Chydoridae	23	24	32	29	24	47
	Total	46	54	57	49	38	85

with the nutrient level in the wetlands of Andaman (Table 4).

The seven regions viz. north, middle, south and little Andaman, Carnicobar, Nancowry

group and Great Nicobar have been divided into two groups for the purpose of the present study.

The four northern regions known as the Andaman group have fourteen or more species

TABLE 3
PHYSICOCHEMICAL PARAMETERS OF THE FRESHWATER PONDS AND LAKES STUDIED IN ANDAMAN AND NICOBAR ISLANDS.

Sl. No.	Name of the pond	Date	pH	Surface water Temp. °C	Conductivity mmhos	O ₂ mg/l	Transparency cm
1.	Mayabundar (NA)	23.01.91	5.5	-	8.70	-	-
2.	Schoolline pond (SA)	28.04.90	-	-	3.80	-	-
3.	Dhobi pond (SA)	21.05.90	8.53	32.3	1.30	4.10	30
4.	Yatrik pond I (SA)	21.05.90	7.95	33.0	2.00	8.10	75
5.	Bay Island Hotel Pond (SA)	25.05.90	8.70	31.2	4.00	10.42	50
6.	Murugankoil pond (SA)	02.06.90	7.09	29.9	2.40	6.05	-
7.	Murugankoil pond (SA)	02.07.90	7.17	30.8	2.00	-	-
8.	Dhobi pond (SA)	02.07.90	7.59	30.2	7.30	-	-
9.	Murugankoil pond (SA)	09.07.90	7.78	31.2	6.90	-	-
10.	Murugankoil pond (SA)	17.7.90	7.29	29.5	7.50	5.70	-
11.	Murugankoil pond (SA)	18.07.90	7.04	30.4	8.00	5.90	-
12.	Murugankoil pond (SA)	19.07.90	7.26	30.2	3.00	5.20	-
13.	Yatrik pond (SA)	27.7.90	8.94	31.5	1.90	6.00	-
14.	Dhobi pond (SA)	18.07.90	8.50	31.5	6.60	10.30	-
15.	Dhobi pond (SA)	19.07.90	7.34	29.7	5.70	5.30	-
16.	Coastguard Pond (SA)	19.07.90	8.36	30.1	2.00	6.20	-
17.	Schoolline pond (SA)	08.08.90	7.35	31.4	0.11	7.78	-
18.	Yatrik pond (SA)	08.10.90	7.26	30.8	2.00	8.00	-
19.	Havelock pond I (SA)	23.01.91	5.50	-	8.70	-	-

TABLE 4
PHYSICO-CHEMICAL PARAMETERS OF THE SURFACE RUN OFF WATER BEFORE AND AFTER RAIN
IN THE CANALS OF PORT BLAIR DURING MAY 1990

Sl. No.	Canals of Port Blair	Conductivity in mmhos		pH		O ₂ mg/l		Total solid mg/l		Dissolved solids mg/l	
		Before Rain	After Rain	Before Rain	After Rain	Before Rain	After Rain	Before Rain	After Rain	Before Rain	After Rain
1.	Murugan temple	4.6	6.9	7.40	7.02	6.54	6.43	120	3800	500	1200
2.	Shadipur canal	2.1	4.1	7.61	7.48	6.34	6.63	340	2000	500	1400
3.	Phoenix Bay canal	8.0	11.3	7.51	7.49	4.27	4.73	3300	5700	1000	2000
4.	Anarkali canal	9.3	8.4	7.88	7.64	6.19	6.53	770	21800	700	2200
5.	Megapod Nest canal	3.3	3.4	7.68	7.70	5.88	6.36	1250	1300	200	900
	Mean	6.0	8.37	7.64	7.49	5.97	6.25	683	6017	533	3000
	Deviation	2.57	4.76	0.17	0.25	0.86	0.76	577	7910	287	3609

of Cladocera each, while the southern three regions known as the Nicobar group have only one to ten species.

The seven stations have been compared by the Sorensen index of similarity. This was calculated for each combination of stations according to the following equation (Sorensen, 1948): $S = 2c/a + b \times 100$, where 'c' is the number of species common to both associations, 'a' the number of species in one association and 'b' the number of species in the other association. The results for 21 pairs of stations are given in Table 5. The indices are generally high, reflecting the small number of species involved and their wide distribution, but the two groups of stations are easily discernible. Andaman group (4 stations) have highly interrelated indices. Those for the Nicobar group are lower, being influenced by the erratic occurrence of eurytopic species such as *Moina micrura*, *Ceriodaphnia cornuta* and *Macrothrix spinosa*, but they are clearly interrelated. Andaman Islands closely resemble each other, the Great Nicobar closely resembles Nancowry group, whereas Carnicobar is unique (Table 5).

Koch (1957) has devised an index of biotal dispersity (IBD) which can be used to assess the wide dispersity of species between islands. $IBD = T/S/S(n-1) \times 100$, where 'T' is the

arithmetical sum of species living in each 'n' compared associations and 'S' is the total list of species in 'n' compared associations. If each station had a completely different set of species, 'S' should equal 'T' and the IBD would be 0%. If each station had an identical set of species, 'T' would equal n x S and the IBD would be 100%.

When the Koch index for all seven stations was calculated, the resulting IBD was 27, but when separate indices were calculated for the Andaman and Nicobar groups, there was an increase in the IBD for the former (40) and a decrease for the latter (18). The large increase in IBD when the Andaman group were considered separately indicates that these

TABLE 5
SORENSEN INDICES FOR CLADOCERA FROM SEVEN DIFFERENT ISLAND GROUPS OF ANDAMAN AND NICOBAR

	1	2	3	4	5	6	7
1	-	53	59	53	13	33	67
2	53	-	64	60	10	25	33
3	59	64	-	68	7	24	45
4	53	60	68	-	10	58	60
5	13	10	7	10	-	40	18
6	33	25	24	58	40	-	43
7	67	33	45	60	18	43	-

1 - North Andaman; 2 - Middle Andaman; 3 - South Andaman; 4 - Little Andaman; 5 - Carnicobar; 6 - Nancowry Group; 7 - Great Nicobar.

regions resemble each other in Cladocera fauna much more than they resemble the Nicobar group. This agrees well with the Sorensen indices.

ACKNOWLEDGEMENTS

I thank the Director, ZSI, Calcutta, Officer-in-charge Andaman and Nicobar Regional

Station and Marine Biological Station for facilities for preparing this paper. I also thank Dr. H.S. Mehta, Shri Bulganin Mitra, Dr. Sanjeev Kumar, Shri P.T. Rajan, Shri Sukla, Shri Ponnusamy, Shri Deivaprakasam and Shri Selvaraj of Andaman and Nicobar Regional Station for their valuable help in collecting the specimens.

REFERENCES

- BAYLY, I.A.E. (1963): Reversed diurnal vertical migration of planktonic Crustacea in inland waters of low hydrogen ion concentration, *Nature*, 200: 704-705.
- CHENGALATH, R. (1982): A faunistic and ecological survey of the littoral Cladocera of Canada, *Can. J. Zool.* 60: 2668-2682.
- CHIANG, S.C. (1956): Some species of *Diaphanosoma* (Cladocera) from Wuchang, China (in Chinese with English Summary). *Acta Hydrobiologia Sinica*, 2: 31-2-341.
- IDRIS, B.A.G. (1983): Freshwater zooplankton of Malaysia (Crustacea : Cladocera), Penerbit Universiti Pertanian Malaysia. 153 pp.
- KOCH, L.P. (1957): Index of biotal dispersity, *Ecology*, 38: 145-148.
- MAMARIL, A.C. (1977): Freshwater zooplankton of Philippines (Rotifera, Cladocera and Copepoda) M.Sc. thesis, University of Waterloo, Canada, 151 pp.
- MICHAEL R.G. & B.K. SHARMA (1988): Fauna of India, Indian Cladocera (Crustacea : Branchiopoda : Cladocera) Ed. Director, Zoological Survey of India, 262 pp.
- MOITRA, J.K. & B.K. BHATTACHARYA (1965): Some hydrological factors affecting plankton production in a fish-pond in Kalyani, West Bengal, India, *Ichthyologia*, 4: 8-12.
- RAJAPAKSA, R. & C.H. FERNANDO (1987): Redescription and assignment of *Alona globulosa* Dady 1898 to new genus *Notoalona* and a description of *Notoalona freyi* sp. nov., *Hydrobiologia*, 144: 131-153.
- SORENSEN, T. (1948): A method of establishing group of equal amplitude in plant sociology based on similarity of species content and its application to analysis of the vegetation on Danish commons, *Biol. Skr.* 5 (4): 1-34.
- VENKATARAMAN, K. (1983): Taxonomy and Ecology of Cladocera of southern Tamil Nadu. Ph.D. thesis, Madurai Kamaraj University, Madurai. 190 pp.
- VENKATARAMAN, K. (1991): Freshwater Cladocera of Little Andaman, *J. Andaman Sci. Assoc.* 6: 60-62.
- VENKATARAMAN, K. (1992a): I. Cladocera of Keoladeo National Park, Bharatpur and its environs, *J. Bombay Nat. Hist. Soc.*, 89: 17-26.
- VENKATARAMAN, K. (1992b): Freshwater Cladocera of Andaman, *J. Andaman Sci. Assoc.* 8: 133-137.
- VENKATARAMAN, K. (1992c): Occurrence of male Cladoceran of *Moinodaphnia macleayi* (King) in oriental region, *J. Andaman. Sci. Assoc.* 8: 179-180.
- VENKATARAMAN, K. (1994): Cladocera In: State Fauna Series 3: Fauna of West Bengal, Part 10: 1-36.
- VENKATARAMAN, K. (1995): Freshwater Cladocera of Tripura State, North Eastern India, *J. Andaman Sci. Assoc.* 11: 15-20.
- VENKATARAMAN, K. & S.R. DAS (1993): Freshwater Cladocera (Crustacea : Branchiopoda) of southern West Bengal, *J. Andaman Sci. Assoc.*, 9: 19-24.

